THE JOURNAL
OF
THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

DEVOTED TO THE ADVANCEMENT OF ASTRONOMY AND ALLIED SCIENCES

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PLATE I

PROFESSOR AND MRS. WILLEM DE SITTER

From a photograph by C. A. Chant taken on November 19, 1931, at the home of Professor E. F. Burton, Weston, near Toronto, Ont.

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WILLEM DE SITTER, 1872-1934

By C. A. CHANT

With Plate I

THE world of astronomy suffered a great loss when Willem de Sitter died on November 21, 1934. He was born at Sneek in Friesland, one of the most northerly provinces of Holland, on May 6, 1872. He began his astronomical career in the Astronomical Laboratory at Groningen of which J. C. Kapteyn was director. Groningen is about forty miles north-east of Sneek. As is well-known, David Gill of the Royal Observatory at the Cape of Good Hope, following the success achieved there in photographing the great comet of 1882, spent four years in photographing the southern heavens and his plates were measured at Groningen over a period of fourteen years, the result being the Cape Photographic Durchmusterung—and numerous important discoveries. De Sitter was at Groningen from 1891 to 1897. When he went there he did not expect to become a professional astronomer but intended to be a mathematician. Gill, when on a visit to the Groningen Laboratory in October, 1896, invited de Sitter to go to the Cape observatory and give assistance in some of the investigations awaiting discussion there. At that time de Sitter was engaged on an examination in connection with his Ph.D. degree and he did not arrive at the Cape until August, 1897. He remained there over two years. While there he performed some observational work on a photometric programme initiated by Kapteyn and also on parallax determinations; but his main interest was in the discussion of observations on the system of Jupiter. This entailed a great amount of calculation and consideration.

In 1908 de Sitter was made professor of astronomy at the University of Leyden and in 1919 he became director of the observatory, the origin of which was in 1633. Under him it was completely reorganized into three divisions: (a) Fundamental astronomy of position or astrometry, (b) Astrophysics, (c) Celestial mechanics or theoretical astronomy; and it is one of the great astronomical centres of the world.

He returned to the satellites of Jupiter again, and from observations of Jupiter made from 1913 to 1922 at the Cape, Greenwich and Leyden, he made a thorough discussion of the system; and indeed from this theoretical work he improved the numerical values of the elements of the solar system, such as the mean radius of the earth, the precession of the equinoxes, nutation, solar and lunar parallax, and the structure and rotation of the earth.

Perhaps he is best known, however, as an investigator of Einstein's Theory of Relativity. Einstein's paper on the General Theory appeared in 1915, and next year de Sitter contributed three important papers on the theory and its astronomical consequences. His examination of it led to the view that the very distant stars and nebulae should show "red shifts", such as would be produced by recessional velocities, a result confirmed by the enormous velocities of the extragalactic nebulae observed in recent years. The very fact that a hypothesis proposed by him has been called the "de Sitter universe" is a tribute to his pre-eminence in the discussion of the difficult cosmic problems. In 1931 he was awarded the gold medal of the Royal Astronomical Society for his theoretical investigations on the orbits of the satellites of Jupiter and for his contributions to the theory of relativity.

De Sitter's mind was of a rare type. It ranged over a wide field and yet penetrated deeply into the very fundamental nature of the things on which observations had been made and which required interpretation.

In the autumn of 1931 Dr. and Mrs. de Sitter came to America and visited a number of centres. They were in Toronto from November 16 to 20. Dr. de Sitter gave two lectures on cosmical problems to representative audiences at the University, a third one on the rotation of the earth to the undergraduate Mathematical

and Physical Society, and also a popular one in Convocation Hall under the auspices of the Royal Canadian Institute and the Royal Astronomical Society of Canada. They were all well attended and fully appreciated. Dr. de Sitter's excellent command of the English language was a subject of comment, but those who were present at the meeting of the International Astronomical Union at Leyden in 1928 will remember how President de Sitter conducted the assembly in English but freely addressed the delegates from France and Germany in their own language. Perhaps he could have used other languages as well. Indeed on one occasion I suggested to him that he could make a speech in Latin. That he would not acknowledge; but after observing the facility with which Latin was used at a special convocation at the University of Leyden I felt confident that de Sitter could express himself in that language also.

During their stay in Toronto Dr. and Mrs. de Sitter were welcome guests at the home of the present writer and charming visitors they were. Dr. de Sitter had world-wide—indeed cosmos-wide—interests and conversed interestingly on many topics. In the leisure minutes he would read German verse or other literature. Mrs. de Sitter came from Java, in the Netherlands East Indies, and while occupying a position as teacher in South Africa met Dr. de Sitter. Her linguistic attainments were quite on a par with those of her husband, and she was well informed on art and on recent English literature of any note.

Dr. de Sitter was tall, with broad shoulders, well befitting one who carried on them "universe B", as he called his theory; but his constitution was not very rugged. Some years before he had been afflicted with chest trouble, but had recovered, and with care his health was good. I have not heard the nature of his last illness. All will regret the termination of his brilliant career at the comparatively early age of sixty-two.

THE WINTER FIRMAMENT

The skies unveil their blue, ethereal light
  In soft effulgence as the dark comes down,
And lay with reverence on the brow of night
  The splendid jewels of their winter crown.

Year after year at her appointèd time
  Immutably rolls on our planet earth,
Making no sound, in silence deep, sublime,
  Around the golden cradle of her birth.

Then one by one bright constellations rise,
  Pass and repass in their eternal flight,
And every orb in lambent beauty lies
  Within its sabled temple of delight.

The silver bells of Pleiades swing high,
  So far and faint we cannot catch their chime,
And Sirius gleams from out the purple sky,—
  The brightest sun in his supernal clime.

The heavens no fairer setting do portray
  Than that wherein the great Orion lies,
Where sword and shield, and triple gems display
  The warrior who treads the winter skies.

Where the Great Dipper in its circle turns
  Above the northland spaces bleak and lone,
There the unchanging fire, Polaris, burns—
  A beacon light within that charted zone.

There is no limitation to the throng
  That floods the space, immeasurable in span;
No paean like their everlasting song
  Has thrilled with wonder since their course began.

And over all eternal Wisdom broods,
  In silent watch above the shining maze,
And from the outposts of their solitudes
  Binds all in chorus of majestic praise.

Toronto, January 1935. ELIZABETH DONALDSON.

MERCURY, A TROPIC WORLD

By William Gifford Hale
(*Of Seattle Astronomical Society*)

THE very interesting article in the Journal for December, 1933, on Mercury by E. M. Antoniadi, prompts me to submit a brief account of the results of a long lifetime of reading and study in matters astronomical concerning this elusive little world.

It is surprising how greatly Mercury and Venus, the planets which, with Mars, constitute our only near neighbours in the solar system, have been ignored in astronomical research. Mars has been much in the spotlight, but Antoniadi's summing up of the known observations show how little we know of Mercury.

Nearest the sun of all the known planets, revolving around it at a distance varying from 28 to 45 million miles, at an average speed around 30 miles a second, in a period of 88 days, in an orbit rather highly inclined to the ecliptic, with a diameter too confidently stated as a bare 3,000 miles; and transiting the sun's disc at intervals, as a small black dot, without a satellite to accompany it. Suspected of having high mountains, because of the blunting of its southern horn; displaying a curious spot of light in the middle of its disc when in transit; and alternately granted and denied an atmosphere by observers. And that was all we knew about this world, one of the nearest celestial objects to us. Again on slight evidence, it was supposed to revolve upon its axis in 24 hours, and was certainly tropic in climate.

And with altogether too scant application of common sense to the facts, it was asserted to be utterly and entirely unsuited to life. Of this more anon.

Because Mercury moves on an orbit interior to that of earth, we have to wait till it gets out to the extreme eastern or western elongation to view it out of the dazzling glare of the solar orb, or else suffer the disadvantage of observing it at or near superior conjunction, when away beyond the sun, at a distance of 130 million miles, when the disc is truly a tiny one. Splendid perseverance on the part of Schiaparelli overcame these obstacles, however, and

after patient years of scrutiny he electrified the scientific world by calmly announcing that Mercury had no daily spin at all, but only turned once upon its axis while revolving once around the sun, thus keeping the same face to it all the time, in the same manner that the moon does to the earth.

He grounded this opinion upon his steady, continued observance of the planet whenever its position allowed him to do so. He saw certain definite slanting lines on its disc, which he averred were always there in the same place, and he drew a sketch-map of them, so strange and unlike anything we had been prepared to see on any planet, that we felt we were facing a new problem in planetary topography, especially when considered in connection with the fascinating puzzle of possible life on such a world.

What these odd slanting lines may mean we can only guess. They are not like earth's continents and oceans in the least, nor do they resemble the network of lines on Mars. Those have a very definite way of converging to a centre, like the railway lines of a busy industrial district. Anyone who tries, as the writer has done, to transfer these lines to the surface of a globe, in the case of both Mars and Mercury, is innately convinced that here we have, not merely a difference in detail, as one might expect on different worlds, but a fundamental distinction in purpose and plan. Of course such a statement invites the thunders of scientific Olympus, which much prefers to consider the planets as just so many dead masses of rock, flying through space without any purpose other than unintelligent physical force,—aimed by nobody at nothing! Thank goodness, the world of thought is at last getting away from this empty view of the universe, so there is now no heresy in thinking of a possible inhabited world beside this earth of ours.

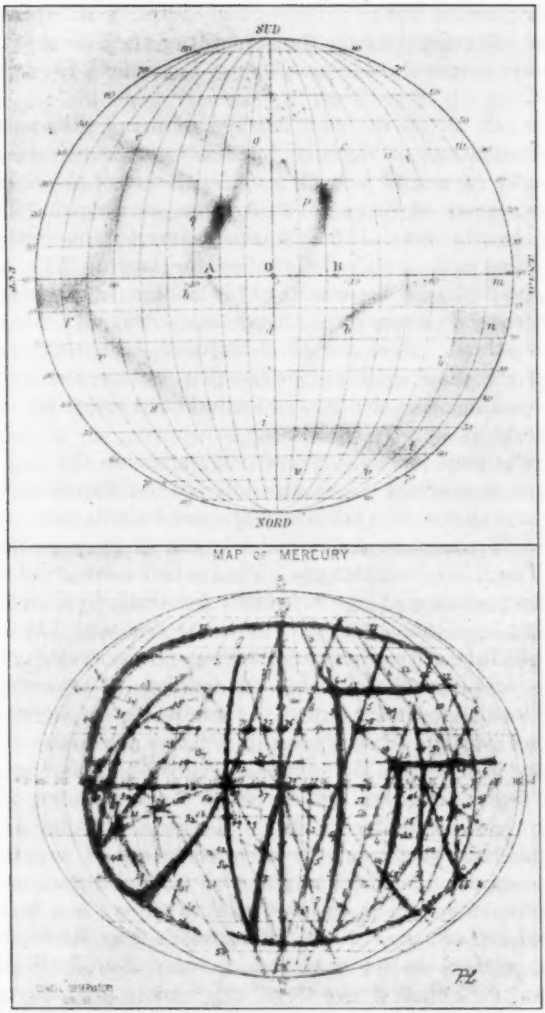
Neither do the lines resemble the strange spoke-like markings Lowell saw on Venus, although that planet, too, presents us with a very live and provoking conundrum of life on a neighbour world. Both Mars and Venus, if inhabited, are confronted with definite irrigation needs, which would be met in totally different ways, according to their so varying conditions. Mars is concerned with the most economical methods of getting water from the melting polar snow-caps to equatorial lands, while Venus would have to draw its water from the periodically-melting front of a gigantic ring of glaciers encircling the sunlit hemisphere. But that is another

story, fascinating in the extreme, and throwing unexpected light upon the life conditions on the satelites of the four giant planets of the outer ranges of the solar system. Let us hark back to waiting Mercury.

Antoniadi recites the contributions of minor observers to the physical conditions of Mercury, but few men took up the study in such deadly earnest as Lowell, a noble pioneer of the skies, in his own observatory of Flagstaff, in Arizona, starting in 1896, uninfluenced by the great Italian's conclusions to any preconceived ideas. Long and steadily he studied the face of little Mercury, and at last presented the results of his labours, supplemented by a map, which again aroused the incredulous scorn and disbelief of the orthodox school. Here are all Schiaparelli's slanting lines, with others of the same kind and orientation, but supplemented by a new set, running like the lines of latitude and longitude on a map of the world.

Lowell's map is puzzling and suggestive to the last degree, though the suggestions will appear different to different minds. He himself says that to him the lines appeared irregular and somewhat suggestive of natural cracks, although he can see the improbability of cracks of such enormous length. We are here confronted with one of the most puzzling things in psychology, the individual variation in drawing and the interpreting of what one sees. It is at the bottom of all the acrimonicus argument about the "canals of Mars", and only friendly toleration for the opinions of others will ever bring ordered knowledge out of the confusing and opposing conclusions of various observers of planetary markings. We have eventually to recognize that two men, clever and conscientious to the last degree, may see and interpret the same thing in vastly different ways. Both are truthful and honest, but they do not see alike, and true knowledge can only come out of a patient and friendly comparing and weighing of their several reports and ideas.

In Antoniadi's article referred to above there is a map which curiously bears out the truth of Schiaparelli's map, for one has only to compare them to see that they portray the identically same markings. Antoniadi draws them wider, more gradually shaded, and as if seen through a greater amount of mist in the air. But the drawings of the lines which Lowell saw on Mars as narrow, sharplyl-defined, and definite, are also by Antoniadi pictured broad and il-



Map of Mercury: *above*, by Schiaparelli; *below*, by Lowell.

(Reproduced here by kind permission of Messrs. Macmillan Co., of New York, from Lowell's "Evolution of Worlds")

defined, in precisely the same way. Evidently the two observers saw the same things with differently-focussing eyes. I cannot see a single marking on Antoniadi's map that is not clearly placed on Schiaparelli's. Put the three maps side by side, Antoniadi's first, Schiaparelli's next, and Lowell's third, and honestly try to reconcile them, and it will be plain that what Antoniadi sees as dim, broad shadings, Schiaparelli sees as more definite outlines, and Lowell as clear, sharp lines. Now remember Lowell's superior location, and his extraordinary powers of vision, and it becomes evident that no number of persons who do not see can negative the observations of one who can. Lowell's cluster of dark lines on the equator, left side of the map, are indicated as broad shadings on the other maps. "Neptuni Vallis" is shown by Lowell as a curved line tapering from north-east tc the equator, and so on.

We see here portrayed on Lowell's map of Mercury's disc a methodically-arranged double set of dark lines, mostly long, narrow, and straight, but some broad and shaded, as a draughtsman would say. Nearly enclosing them is a great, dark bounding curve, at what is practically the outer extent of the sunlit side. Schiaparelli's, as well as Lowell's, conclusions infer that Mercury has one side turned towards the sun all the time, while the other never sees the sun at all. Lowell says the lines to him appear irregular, somewhat suggestive of natural cracks, but he draws them straight, and regular, as definitely arranged as he does the "canals" on Mars. Which view are we to adopt? I think the latter, for natural cracks would not form, much less persist, as permanent features of a planet's surface, on a scale so gigantic. For many of these lines reach right across the disc, a distance of more than three thousand miles, while the great bounding curve is thrice that length. Add to this a preconception in Lowell's mind, made evident by his later description that Mercury is just a desolate, sun-baked desert, and we have ground enough for taking his drawing, rather than his description, as the true depiction of what he saw.

The whole inference from this would be to suppose the lines artificial, with all the staggering conclusions which hang upon such an opinion. To better grapple with the problem, let us try now to picture just what the surface conditions of Mercury must be like. If we stood on the sunlit side of this strange little world we should see overhead an immense sun, five times bigger and hotter than it

appears to us on earth, swaying slowly from side to side in month-long movements, but never setting. Under its terrific heat and glare no creature that we know could live. Water would promptly boil away, and even lead would melt. In the centre of this super-tropic side there would be an immense up-draft of hot air, carrying with it any moisture, and blowing it away to the dark, cold side, the hemisphere that never sees the sun.

A very essential point of proof to this picture is contributed by Antoniadi himself now, by his observations of clouds, for clouds cannot rise or blow along without an atmosphere to sustain them. If now we wished (as we probably should!) to flee from this never-ending torment of heat and light, we should have to walk across the disc until we neared the edge of the dark side. As we proceeded we should see the sun sinking lower and lower in the sky, until we should reach a point where it would hang motionless on the horizon, a lurid furnace of fire. Our farther progress would take us out of this tropic land into a world of eternal night and arctic cold; and ere long we should probably encounter a vast range of ice mountains, composed of the former oceans of Mercury, piled up here ages ago by the unceasing winds blowing over from the hot side. (Well I know some will here interpose a "No, No, Nannette", on Johnstone Stoney's authority, that Mercury was never able to retain an atmosphere or water vapour.) What, then, blows the clouds along? If Mercury traced out a uniform circle around the sun that ice-desert would forever remain dead and frozen. To such a pass have the "body-tides" of the sun brought this little planet. But we know that its path around the solar orb is far from such model rectitude. It is so eccentric that the planet's distance varies all the way from 28 to 45 millions of miles, which introduces a strange but real seasonal variation of heat and light on the sunlit side, the sun shrinking and swelling in apparent size from four to seven times its size, as we on earth see it.

The same variation causes a libratory swing of the sun in the sky, as Mercury's speed in orbit changes from 24 to 30 miles a second, while its revolution on its axis remains constant. Thus at one point of its track the eastern side of the dark hemisphere for some weeks swings out into the sunlight and heat, for several hundred miles, and then the western half has its turn. So on these

border lands one would see the sun slowly rise, hang awhile motionless, then as slowly sink to its setting again.

Here, then, we should find a true day and night, of long enough duration to allow the ground to cool thoroughly, and temperate enough when hottest to permit the growth of vegetation, if other conditions were also there. So we find that all this talk about Mercury being totally uninhabitable, because one side is melted while the other is perpetually frozen, needs the interpolation of the common-sense statement that between these two extremes of temperature there must certainly be a temperate zone (500 miles wide at the equator) where it is mostly afternoon. Think, too, that just in this zone would be the only possible belt of rains, for the wide libratory swing would bring great areas of the dark, cold side into temporary light and heat, and temporarily, too, would melt some of the ice and snow stored up there. This would be the only place where vegetable life would be possible, all around the edge of the sun-lighted hemisphere. Is it not a very suggestive thing that precisely in this zone the darkest and heaviest markings are shown on Mercury's disc in Lowell's map? A sharp watch for seasonal variations in these markings, their depth and character, might likely reveal evidence of the growth and decay of plant life. Selective photography might perhaps tell if chlorophyll is present there.

Other broad, dark markings are recorded, some latitudinal, some meridional, which may be deep, shadowed valleys or canyons, for, remember, the sun would only be vertical over a small part of the disc at a time, and a deep canyon would certainly be shaded at the bottom, as are the canyons of western America. Suppose now, for the sake of argument, that Mercury was at one time habitable in part, and that life had hastened to its flowering into an intelligent form, as it will do anywhere if the conditions are right. Life requires light, warmth, water and air. Light, warmth, and air (of a sort) are undoubtedly there, and if air, probably water, too. Intelligent creatures would perforce stay in the libratory zone and the polar regions, where it was coolest, and their agricultural operations would conserve and use the water from the melting glaciers aforesaid. Apart from a very few of the central lands there would always be some valleys in shadow, and these might be the only possible routes of transit across the central torrid desert. Could they not have become the favoured ways across? And might they not be

kept deep and narrow on purpose for such travel-ways? So on the border zones a super-tropic civilization might flourish.

Atmosphere Mercury almost certainly has, for white spots have been seen on its terminator, and moving spots mean air and water, or dust. High mountains are strongly suspected near the south pole. Some definite meaning must attach to these mysterious markings, and ordinary natural formations seem ruled out of the question by their definite, methodical order and orientation. Years ago, for an astronomical class which I conducted in Truro, England, as its city librarian, I patiently plotted Lowell's markings on a nine-inch globe, and it was borne in upon my mind with convincing force that here we have no chance happenings of nature, but, as on Mars and Venus, the visible evidence of active intelligence combatting the natural handicaps of planets strangely circumstanced; a challenge to our mental powers to interpret.

The truth is, that many of us are still unconsciously biassed by the old idea that our world is the centre and most important planet in the universe, and that prejudice inclines us to deny the possibility of other worlds being inhabited by races of beings as intelligent as ourselves. For the credit of the universe let us hope that some planets are the home of races much more, and not less, intelligent than one which wastes such titanic wealth on foolish war. When we really take all the factors and conditions of the manifestations of life into account, we can logically open our minds to the probability of not one, but many, other planets being the homes of reason, invention, civilization, and spiritual growth.

Let us get back to our Mercury. Early observers have agreed with modern ones that there are notable mountains near Mercury's south pole, even of prodigious height. Evidently Mercury is a mountainous, rugged little world, which fact lends weight to our theory of the sheltered canyons. (By the way, is it just coincidence that both the earth and the moon have also great elevations near the south poles—the antarctic plateau, and the Doerfel mountains? Such coincidences almost always mean something definite.) Does Gregory's theory of "tetrahedral collapse" apply to other worlds as well as ours? Most astronomers concede Mercury some atmosphere, though they vary greatly as to its amount, some thinking it dense as ours, and others that it is very thin, lacking in the lighter gases, and probably including some such heavy gas as carbonic

anhydride, which would cling close to the surface and in deep valleys. This last-named gas is a great nourisher of plant life. Animal life would have to adapt itself to such an atmosphere, as certain insects do, for the resources of nature are boundless in this matter of adaptation by evolution, and we have to admit that she could devise a life-form that could not only survive, but flourish in such gas, extracting the oxygen from it as fishes extract the oxygen from water.

Mercury's proximity to the sun would imply very tense, extreme electric and magnetic conditions, causing possibly greater activity in all vital processes. Besides, let us remember that Mercury, like all the other planets, was undoubtedly intensely hot when first torn from the sun by a passing star, and its nearness to the sun may have prevented its ever cooling to the same degree as some others farther away. So some modicum of heat may steadily creep through to the dark side, through the body of the planet. Granting atmosphere, it is just possible that Mercury's "night-lands" may be inhabited, too, though by a fundamentally different kind of creature from those of the light side. They would have to be gifted with a constitution able to withstand a continual low temperature, and their vision would be adapted to seeing by starlight, which, after all, is very far from absolute darkness. In their sky would shine, most of the time, either Venus or the earth, both stars of great lustre. Such stars might well, as the late gifted Garrett Serviss suggested in his "Columbus of Space", evoke the worship of the dwellers in the "night lands". So our earth may be to them the dwelling-place of gods, and their lovers may look up at our magnificent star as strolling sweethearts here regard the lovely "Evening Star".

Yet another mystery: Whenever Mercury passes in transit over the disc of the sun keen-eyed observers have reported to have seen, upon the tiny black circle of the planet, a bright spot, according to the time of our year, to the left or to the right of the centre of the disc. On quite insufficient evidence, or opinion, it has been hastily assumed to be merely a contrast effect, from the surrounding glare of the sun, but Flammarion thinks otherwise. Early observers thought it might be a volcano in eruption, but its permanence negatives that. A mere optical effect would always occupy the same place on the planetary disc. To indulge in another daring flight of fancy:—If any intelligent race does occupy the night side

of this strange little world, they could select no better time for trying to attract the attention of us earth-dwellers, by a big "flare", than at these transit periods, when the tensest scrutiny of our best astronomers is focussed upon their planet.

To sum up, therefore, Mercury is considerably bigger than we thought (3,400 miles in diameter, instead of the 3,000 it has hitherto been allowed). It has an intensely hot side, crossed by the most challenging sets of lines imaginable, involving a mystery beyond that of any other planet we know; and a dark side of unending cold, starry, winter night; but between these two extremes a wide habitable zone, where heat and glare are moderated, and a semblance of seasons exists, or day and night alternation, from the effects of libration; and where water may be present in small amount. A limited atmosphere of heavy gasses, not necessarily hostile to every form of life—and we know that on earth life exists wherever these conditions prevail,—so why not upon this mysterious little world of Mercury?

I have an unconquerable aversion to thinking of the universe as a mass of "dead" matter. What? All these myriads of shining suns and flying globes encircling them, and this our little planet the only abode of life and intelligence? Such a belief withers flowers and stars to "carbon compounds" and dead, insensate rocks, truly a universe of death, which the wonders of life here forbid.

No. To the power of God in creation there is no limit, and we may be thankful to think that the process of thought has so far liberated our minds that we may freely and logically reason, from the facts of life on our earth, that life of an intelligent type has been evolved upon many worlds that we had unthinkingly banished it from. Mars, Venus, and now Mercury, show highly suggestive signs of living, active intelligence combatting the obstacles, and using in power the resources of strange worlds to serve their purposes; and we may yet hope to learn of and from them. For all we know, the planets and stars may themselves serve as "bodies" to cosmic intelligences, as Fechner suggests and Algernon Blackwood supposes.

So our horizon widens as our thoughts contemplate a universe not dead, but forever alive, conscious, and forever "moving on".

> In Reason's ear they all rejoice, and utter forth a glorious voice,
> For ever singing as they shine, the Hand that made us is divine.

NOVA HERCULIS 1934

By P. M. Millman

Every now and then, in some way not completely understood, one of the billions of stars in space loses its normal state of stable equillibrum and, as it were, blows up, sending off great shells of gaseous material that travel with tremendous velocities. When this happens the star suddenly brightens, sometimes to several hundred thousand times its former luminosity and if it is located in our part of the galactic system, what was once a faint object seen only in large telescopes becomes easily visible to the naked eye and may out-shine even the brightest stars.

Such an event has just occurred in the general direction of the bright star Vega and as a result we have a new object visible in the northwest just after sunset and in the northeast just before sunrise. On the evening of Dec. 13 J. P. M. Prentice, an English meteor observer, noted a new third magnitude star half way between Lyra and the head of Draco. It lies just within the boundaries of the constellation Hercules and so is known as Nova Herculis 1934. (We still retain the term "nova", meaning new, a name first applied in the middle ages when such objects were thought to be actually new stars). Nova Herculis, contrary to the behaviour of most novae, brightened steadily for over a week after it was discovered and by Dec. 22 was of magnitude about 1.5. It then dropped and was fainter than third magnitude on Dec. 26 but at the date of writing seems to be brightening a little, being estimated by the writer as of magnitude 2.8 on the evening of Dec. 30. This star will provide an excellent opportunity for amateurs who wish to make magnitude estimates as it will probably remain visible to the naked eye for some time and will likely fluctuate in brightness even in the course of twenty-four hours.

Nova Herculis appears about 8 degrees north of Vega and is well visible in the northwest shortly after sunset. It forms a triangle with the two brightest stars in the head of Draco. The exact location may be seen from the accompanying map and its brightness can be estimated by comparison with nearby stars whose magnitudes are given to the nearest tenth of a magnitude, the decimal point being omitted. Estimates of magnitude should be accompanied by the time at which they were made to the nearest five minutes and a list

of the comparison stars used. If sent in to the writer they will be forwarded to the A.A.V.S.O. headquarters where such observations are collected and studied.

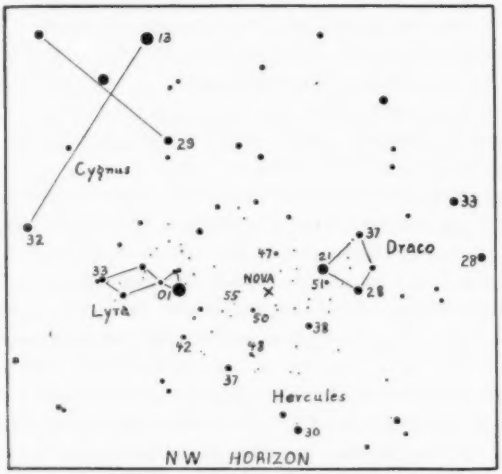


Chart Showing Position of Nova 1934

Search of old plates at Harvard has shown that Nova Herculis 1934 existed previously as a star of 14.6 photographic magnitude and was not brighter than magnitude 13.8 as late as Nov. 14, 1934. Its total increase in brightness was 13 magnitudes which corresponds to an increase in luminosity to 160,000 times its former value. Dr. Struve of the Yerkes Observatory estimates that the star is not much further away than 1600 light years. Photographs of the spectrum taken at Harvard and Flagstaff show rapid changes taking place and the presence of both emission and absorption similar to that of other novae.

Nova Herculis 1934 is the first bright nova visible in the northern hemisphere since 1920. Its exact position as given by Dr. Van Biesbroeck is R.A. 18h 4m 40s.5 (1900), Dec. + 45° 50′ 40″ (1900). It should be carefully followed by those who have telescopes after it has become invisible to the naked eye.

CALENDAR REFORM

By W. E. Harper

LET me give you in a sentence or two what is meant by calendar reform and why it is urged. It comes as a request—really a demand—from big corporations who make comparisons of their business returns at stated times and find the present calendar unsuitable for such purposes inasmuch as the months, the quarter-year and the half-year are each of unequal lengths. Moreover, in any one month there may be a different number of special days of the week, such as Saturday, for example, when a greater or less volume of business than the average is the rule. It is thus impossible to compare, say, November of the past year, with four Saturdays, with November of the present year, which will have five. Should the month under consideration be April it might happen that Easter occurred in that month in one case and not in the other, again making comparisons inequitable. Such anomalies are too self evident to require elaboration; they do prevent the accurate comparisons so greatly desired.

I confess being unable to enthuse greatly over the need for reform, simply from the standpoint of big business. The injunction of Holy Writ seems apropos: "What shall it profit a man if he shall gain the whole world and lose his own soul?" Captains of industry, statisticians and others urging calendar revision should remember that there are others who do not make a god of industrial efficiency and who are moved more by the common things in life. Such would oppose any radical change, wiping out cherished anniversaries whether religious, domestic or national. It would be folly to ignore the memories and susceptibilities of the common folk. Nevertheless, business being conducted as it is, we ought to pay some attention to its requests and since other advantages accrue from calendar reform it is only reasonable to consider the question.

Let us see how our present calendar originated. Six thousand years ago the Egyptians had a year of 12 months of 30 days each, plus 5 days devoted to religious festivals. From this religio-lunar

system, descended through the Romans, has come our calendar of to-day. But before the time of Julius Caesar there were so many complications through special observances to gods and emperors that the calendar was in a bad way with winter, according to their reckoning, beginning in September. To straighten things out and co-ordinate sun, moon and seasons Caesar called in the Egyptian astronomer, Sosigenes, who formulated what was known as the Julian Calendar, adopted in 46 B.C. The solar year was counted as 365¼ days almost its true value, and so every fourth year was to be a leap year with 366 days, the ordinary year having 365.

According to this the months were to have alternately 31 and 30 days, but as this would total 366 it was decreed that for the ordinary years February would have only 29. When Augustus Caesar came to the throne some years later he did not take kindly to the idea that his month, August, should have only 30 days whilst that of Julius (July) had 31 . . . . All the 'Gussies are not dead yet I fancy! . . . . Accordingly poor old February was again the victim, leaving it with 28 in ordinary years and, of course, 29 in leap years. Thus we have the well known nursery rhyme:

"Thirty days hath September
April, June and November . . . ."

When the Julian Calendar was adopted it was thought that the year was so accurately determined as 365¼ days that the seasons would forever fall at the same date. Such was not the case though. The true value of the year is one between 11 and 12 minutes shorter than they had supposed and so the sun would gain that many minutes each year on the calendar. In 128 years it would gain a whole day so that the spring equinox would occur on March 20 instead of March 21. By the year 1582 A.D. the discrepancy had amounted to over 10 days when Pope Gregory, with the aid of his astronomers, mathematicians and priests rectified the error by dropping 10 days from the calendar and instituting a new rule for leap year. In brief, the century years must be divisible by 400 instead of by 4 before they can be classed as leap years.

The Gregorian Calendar, as it was called, was adopted at once by the Catholic countries, Italy, France, Spain and Portugal, and in the following year by Switzerland and the Netherlands. In 1609

it was adopted by the Protestant States of Germany and in 1752 by Britain and her Colonies, including the United States. Recent adoptions have been by Japan in 1873, by China in 1912, by Turkey in 1917, by Russia in 1918 and by Greece in 1923. That brings it up to date.

In any of the schemes of reform it is intended to stabilize the date of Easter. Such of course could be effected without any calendar revision but it is felt that nothing will be done until the calendar itself is tackled. By the old rule for determining Easter based upon the Jewish lunar calendar, the date may fall anywhere from March 22 to April 25, inclusive, a leeway of 34 days. By commemorating it on the Sunday nearest to the date of the first Easter in terms of our solar calendar we shall never be "out" by more than a week and a fixed date about midway between the two extremes would seem to fulfil all desired conditions.

At Geneva in 1923 a conference of some of the leaders of the largest religious bodies was held. Among others, Cardinal Mercier represented the Holy See, the Archbishop of Canterbury spoke for the Anglican Church, whilst there was also a representative of the Greek Orthodox Church. These leaders agreed that on the score of dogma alone there seemed to be no fundamental objection to fixing the date of Easter but urged that the consent of all Christian bodies should first be secured. Later, however, in December, 1932, the Holy See informed the League that the stabilization of Easter was a pre-eminently religious question which fell within the acceptance of the Holy See and that a change in this matter could not be contemplated. Such attitude would seem to postpone for a while any action looking to stabilization although the British Parliament in 1928 passed a Bill to adopt the date previously agreed upon, the Bill to be proclaimed law when other nations are ready to do likewise.

The advantages of a fixed Easter are obvious. Merchants and manufacturers could plan their business much better. With uniform periods in the school term from year to year it would be easier to plan the curriculum of studies. In the realm of law the assize courts would meet at a definite date in every year. All movable feasts depending upon Easter would automatically become fixed, further enhancing these advantages.

The two main systems are what may be called the 13-month and 12-month schemes. The former was first mentioned by the French Philosopher, Comte, afterwards adopted by Cotsworth (now a resident of Vancouver) and given wide publicity in recent years by the late Geo. Eastman of Kodak fame. It is erroneously stated in articles that it received the endorsation of the Royal Society of Canada in 1909. It is the scheme, however, which our Canadian Government instructed its delegate, Cotsworth, to vote for at the League of Nations in 1931.

There are 13 months of 28 days each, making 364 days in all. The extra day is named Year Day and has no week designation, but is observed as an international holiday at the end of every year. In leap years another such day, designated Leap Day, is likewise observed as an international holiday at the end of June. The new month, Sol, is introduced between June and July.

Since every month begins on a Sunday and ends on a Saturday with four such complete weeks and no more in each month, it is very advantageous for statistical comparisons.

Apart from religious grounds it is claimed there will be objection to its seemingly radical nature. The dates of all birthdays or anniversaries occurring on the 29th, 30th and 31st, will necessarily have to be changed to the corresponding dates in the new system. It is argued that on sentimental grounds such departures from the present calendar will not find favour with the common folk and the possible strength of such opposition would militate against its likelihood of adoption. Then there is the objection of the number 13 not being divisible into the half and quarter years corresponding to the natural division of the seasons. Moreover, the extra cost imposed upon business concerns of having 13 instead of 12 monthly audits, returns, etc., means an 8 per cent. increase in the cost of business.

The 12-month, equal quarter, plan deals with Year Day and Leap Day as in the foregoing and divides the remaining 364 days into four equal quarters of 91 days or 13 weeks. The first month of each quarter has 31 days; the other two have each 30 days. Each quarter begins on a Sunday and ends on a Saturday. While one month in each quarter has a day more than the other two, yet this first month has five Sundays as compared with four in each of the

other two, so that each month has the same number of working days, namely 26. Like its 13-month rival any particular date falls on the same day of the week each year so that comparisons of any day or of any month with those of another year are just and equitable.

In this arrangement there are only 7 dates changed as compared with 58 in the 13-month revision and yet with this minimum of change it is claimed, by advocates of the 12-month system, that we have all the desirable features that big business is demanding for comparative statistics.

The only serious objection to revision is based upon religious grounds and it affects both 12- and 13-month calendars alike. By omitting Year Day every year and Leap Day every four from the calendar and considering them simply as holidays, there is a break in the seven day cycle against which the Jews, Seventh-Day Adventists and Seventh-Day Baptists protest strongly. They claim the seven day cycle has existed from the beginning of things and these days are regarded as the direct descendants of the days of Creation spoken of in Genesis. They must observe the "seventh day and keep it holy", which would be impossible if Year Day and Leap Day were authorized.

It would be doing these Sabbatarians a grave injustice to suggest that they are unreasonable or intolerant in thus holding on to such a distinctive belief. In the final analysis of course, after due consideration is given to the rights of minorities, the majority must decide. With a world membership of 300,000 for the Seventh Day Adventists and an approximate Jewish world population of 15,000,000 it is seen that these opposing parties constitute less than 1 per cent. of the world's population, so that they must recognize the rights of the other 99 per cent. should the latter decide for revision.

One cannot but feel though that the objections of these people are based upon a genuine misunderstanding. Even if we were to accept the six days of Creation in a literal sense as being identical with our days, there would still remain the difficulty of believing in an unbroken continuity of weeks and designated days from the beginnings of world structure to the present. I believe foremost Jewish authorities recognize three different calendar systems as employed at different times in ancient Israel and so it is hard to agree with

those who hold that the present seventh day of the week is the direct descendant of the one observed in the late days of the writer of the Creation story, to say nothing of one dating back to Creation itself.

I think most Christians would accept the arrangement of the new calendar in which Sunday has its rightful place as the first day of each week. I do not think calendar reformers are out to destroy the weekly day of rest, a divine ordinance which has been of the greatest blessing to mankind. To the credit of those opposing reform it must be stated that they suggest a revision agreeable to them in which the odd day is held over for five or six years until seven have accumulated when an extra week is added to the year. Such would not meet the requirements for comparative statistics any better than the present. A way out of the impasse would be for those countries who so desire it to make one or both of these two days not only holidays but religious holidays and this detail might overcome the opposition now levelled at reform. Such action regarding details would have to be left though to each country to settle, as we are speaking in terms of a world calendar and many nations are outside the pale of our Christian religion and have no concern in the question at issue.

The thing we must not do is to try to force the reform upon a world unready to receive it. We must educate the common people to what is involved in the change and what benefits are likely to accrue from it. In due time their desire for change will become insistent enough for enabling legislation to be passed in all the countries of the world. Since many publications, like Nautical Almanacs, are printed years in advance a common date for its adoption must be selected some years ahead. Those who realize such things and the intertia that must be overcome before enabling legislation can be passed in all countries will be amused at the way some politicians expect to put the thing over at once. The years when the scheme could start, with Sunday falling on the first day of the year are 1939, 1944, 1950. It would seem that 1950 would be about the earliest that one could expect sufficient unanimity throughout the world to adopt even such a mild revision as that contemplated in the 12-month, equal-quarter calendar.

REVIEW OF PUBLICATIONS

The Search for Truth, by E. T. Bell. Pages ix, 279. Baltimore, Williams and Wilkins, 1934. $3.00.

In the last fifteen or twenty years many books have been written which deal with the descriptive aspect of modern problems of science. In such treatments we are apt to lose sight of the fundamental assumptions from which conclusions are obtained and on which theories are based. The dangers consequent to this neglect are ably described in this excellent book by Dr. Bell. As he says ". . . . . altogether too much faith has been put in the 'truth' of results reached by mathematical or logical reasoning, or indeed by any other proces of rigid, deductive reasoning".

The discussion in his book centres on the question "What is truth?" Dr. Bell traces the story of man's search for the answer over a period of roughly 6000 years, from the time of the early Egyptians until the present. Very early there arose "doubts which trouble us to-day, and which, historically at least, are responsible for the advances of recent years . . .". Generally speaking, "we see four great peaks towering above the general level of profound or lofty speculation on the nature of truth. The first of these marks ancient Egypt, say 4241 B.C. to 1800 B.C.; the second, the early Greece of Pythagoras in the Sixth Century; the third, the invention in 1826 by Lobatchewsky of Non-Euclidean Geometry; and the fourth, rising in 1930, the creation, by Lucasiewicz and Tarski of strict deductive reasoning radically different from the traditional logic of Aristotle . . ."

Although a comparatively small portion of it is devoted directly to astronomy, the book is recommended to all who aim to make an intelligent study of present theories of our universe. The reader will find a vivid, fascinating, and thought-provoking discussion, and one that should cause him to be more cautious and critical in his future reading.

In addition to being an able mathematician, Dr. Bell is the author of many "scientific novels". It is not surprising, therefore, to find "The Search for Truth" comparatively free from the technical jar-

gon. The novel presentation and delightful humour aid in making the book extremely interesting and worthwhile.

WALTER H. GAGE.

Tafeln zur Theoretischen Astronomie, by Julius Bauschinger, second edition by Gustav Stracke. 192 pages, 8x11 in. Leipzig: Wilhelm Engelmann. Price 25 RM.

Since the appearance in 1901 of the first edition of these tables, which were very widely used by those engaged in computational astronomy, conditions have arisen which render a second edition advisable. The *Berliner Jahrbuch* has adopted the zero meridian of Greenwich instead of that of Berlin. Greenwich Civil Time, hours beginning at midnight, has superseded the astronomical time with the hours numbering from noon. The computing machine has also become an important adjunct to logarithm tables, and natural trigonometric tables to more decimal places have appeared. In the methods of the computation of perturbrations, approximate methods have necessarily been adopted for the great number of asteroids which have been discovered. Considerable alterations in the first edition have been made to meet these changed conditions. Many new tables have been included and others altered or omitted.

The volume includes 56 tables and is divided into six parts. In the first part, consisting of ten tables, are found tables for finding the Julian Day, the beginning of the Besselian fictitious year, the conversion of time into angles, sidereal into mean time, angular measure into radian measure, etc. Tables for computing the true anomaly for elliptic, parabolic or near-parabolic orbits are found in the second part. The third part includes eleven tables to facilitate the computation of orbits either with the machine or by logarithms. Tables for the computation of special perturbations and for the differential corrections to preliminary orbits are in the fourth part. Precessional tables and tables for the transference of orbital elements from one epoch to another make up the fifth part, and the last section is devoted to mathematical tables, interpolation, the probability integral and several tables of mathematical and astronomical constants.

The volume is well bound and the printing and paper are good.

R. K. Y.

METEOR NEWS

Observations relating to meteors and meteorites are cordially invited.

Observations of the 1934 Leonids

In spite of the small numbers of Leonids which appeared in 1933 it was hoped that in 1934, by some fortunate chance, we might intercept a richer portion of the Leonid swarm. The observations made in Ontario indicate that the Leonids were only slightly more numerous in 1934 than in the previous year and it is now fairly certain that the earth, as in 1899-1900, has once again missed the main group of these meteors. On reviewing the history of the Leonids, however, it is noteworthy that the interval between successive great showers has varied from 32 to 36 years and that on several occasions in the past the earth has apparently missed one, two, or even three successive returns of these meteors. For this reason they should be closely followed by the meteor enthusiast but during the next two decades the most definitely profitable seasons for meteor observations, both visual and photographic, will be during the annual returns of the Perseids in August and the Geminids in December.

Leonid observations were planned at the David Dunlap Observatory on the four nights, Nov. 14-18. The first and third nights were clear and a programme similar to others reported in these pages was carried out. On Nov. 16-17 a party of four observed at Belwood, a station about 60 miles west of the Observatory. Polar reticles were used at both stations on this night and a large number of observations for height computation were obtained. In addition to these two stations several smaller groups reported, including members of the Ottawa, Hamilton and Toronto centres of the Society. A total of 1270 individual observations was received. Many observers, particularly those located in the west of Canada, were prevented from observing by poor weather conditions throughout the maximum nights. Those taking part in the Leonid observations are listed below:—

Leonid Observation Groups

1. David Dunlap Obs.
   Nov. 14-15—G. H. Cooper, Miss V. E. Foster, J. H. Fee, W. M. Gray,

R. J. James, T. R. Jones, Miss M. E. Jupp, R. B. Laing, P. M. Millman, Miss L. E. Pallett, Miss F. S. Patterson, J. A. Robins, A. H. R. Smith, Mrs. D. Smith, Miss M. J. Thomson.

Nov. 16-17—E. C. Aho, Miss D. M. Boyd, G. A. Charlesworth, F. E. Coombs, J. K. E. Cox, B. S. V. Cudbird, W. M. Gray, J. S. Lang, Miss M. E. Mactaggart, P. M. Millman, E. E. Minett, Miss R. J. Northcott, J. T. Orgill, Miss F. S. Patterson, H. B. Shipman, M. D. Stewart, Miss M. J. Thomson, A. Vaughan, E. R. Whitby.

2. Belwood, Ont.—T. R. Jones, R. B. Laing, T. C. Poole, J. A. Robins.
3. Dom. Obs., Ottawa—K. Buckthought, Miss M. S. Burland, M. M. Thomson.
4. Hamilton, Ont.—Wm. Findlay, A. E. Johns, J. A. Marsh.
5. St. Catharines, Ont.—J. L. Lay.
6. Huttonville, Ont.—P. Perry.
7. Hamilton, Ont.—E. E. Bossence.
8. Sheridan, Ont.—S. Rasmussen.

The actual numbers of meteors observed by the various groups are listed in Table I. These have been converted to hourly rates for six observers by use of the factors given in Meteor News for March, 1934. The hourly rates are plotted in Figure 1 while the magnitude distributions are given in Table II. It will be noted that on Nov. 14-15 the maximum Leonid rate was 50 per cent. higher than on the corresponding night in 1933. On Nov. 16-17 though very few Leonids were seen during the first half of the morning hours there was a marked increase in the rate about 3.30 a.m. which is not accounted for by the setting of the moon nor the presence at intervals of a few light clouds. Apparently at this time the earth actually ran into a denser portion of the meteor swarm. The maximum observed rate on the second night was about 75 meteors per hour for six observers, equivalent to just over 20 per hour for a single observer plotting and less than half the maximum rate observed in 1932. The meteors observed at the Dunlap Observatory on the second night were on the average almost half a magnitude brighter than those observed on the first night. The mean magnitudes of the meteors observed in 1934 are about the same as those for 1933. No remarkable meteors were seen, the brightest bursting to about magnitude -3 and having a train lasting for 20 seconds. The writer would like to thank all those who so ably assisted with this programme.

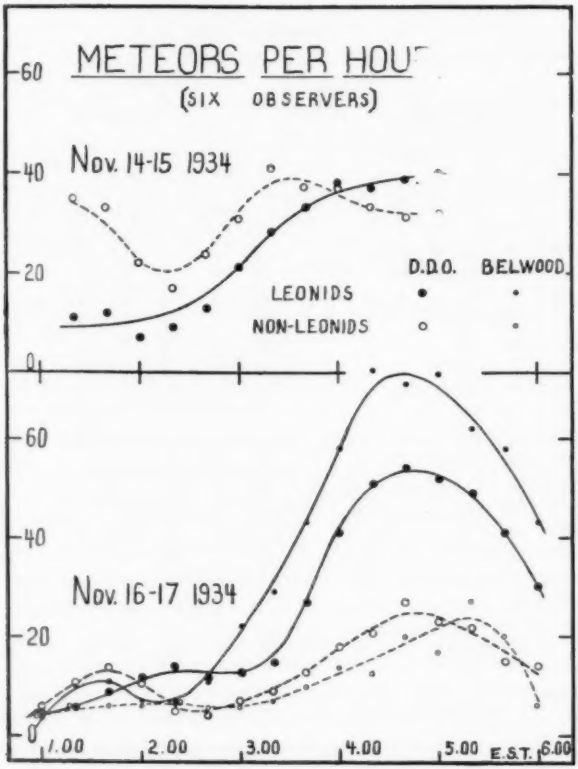
TABLE I

Date	Nov. 14-15				Nov. 15-16		Nov. 16-17							
Group	1		3		4		1		2		3		4	
E.S.T.	L	NL	L	NL	L	NL	L	NL	L	NL	L	NL	L	NL
12.50-1.10	1	5	0	1			2*	0	1	1				
1.10-1.30	8	19	2	4			2	6	3	1				
1.30-1.50	4	14	4	4			4	9	3	2	0*	2		
1.50-2.10	3	7					6	4	2	1	2*	2		
2.10-2.30	1	5					6	2	0	1				
2.30-2.50	4	5	3	7			6	1	3	3	1	4		
2.50-3.10	7	12	1*	2			3	2	5	0	3	2		
3.10-3.30	9	13					6*	5	7	1	12	2		
3.30-3.50	14	18					7	3	8	4	5	2		
3.50-4.10	12	9	1*	3	4	3	16	6	15	2			1	2
4.10-4.30	13	11	0*	1	4	5	22	11	17	5			3	1
4.30-4.50	10	11			2	3	21	7	19	2			6	1
4.50-5.10	12	6					23	15	13	7			5	2
5.10-5.30	7	6					23	7	18	3			6	1
5.30-5.50							17	6	12	9				
5.50-6.10							11	5	10	2				
Totals	105	141	11	22	10	11	175	89	136	44	23	14	21	7
Average no. of observers	7		3		2		10		3		3		2	

Date	Group	Time observed	L	NL
Nov. 14-15.....	5	11.35-12.35	0	4
	6	3.20- 3.40	4	1
	7	4.10- 5.40	6	2
	8	12.40- 2.00	4	5
Nov. 16-17.....	5	4.50- 5.30	5	2
	6	3.50- 4.50	5	0

Total Leonids observed (L) 505
Total non-Leonids observed (NL) 342 Total meteors observed 847

*Clouds.



Hourly Rates of Leonids 1934

TABLE II

Mag.	−3	−2	−1	0	1	2	3	4	5	Totals	Mean Mag.
D.D.O.											
Leonids	1		4	17	51	82	91	26	3	275	2.18
Non-Leonids				12	31	64	62	38	11	218	2.54
Other Groups											
Leonids		1	8	11	24	34	41	28	13	160	2.42
Non-Leonids		1		7	16	15	17	10	15	81	2.62

PERSEID PHOTOGRAPHY

Word has been received from Dr. Astapowitsch at the Leningrad Observatory that during the observations of the Perseids conducted in the U.S.S.R. in 1934 Mr. K. B. Stanjukowitsch photographed a good meteor spectrum showing detail of 40 to 42 lines. The meteor was of magnitude −3 or −4 and appeared at 22h 20m G.C.T., Aug. 12, 1934. Direct photographs of the same meteor were secured from two points, one of these being taken with a rotating sector. Very complete information as to the height and velocity of this meteor is thus available. It must be remembered that the first successful attempts in meteor spectrophotography were made at Moscow by Dr. S. Blajko some 30 years ago and the Soviet astronomers are to be congratulated upon the recently awakened interest in meteor photography and in other branches of meteoric astronomy.

Mr. Oscar E. Monnig reports that the Texas Observers secured two faint Perseid spectra in their 1934 observations. They also secured 8 or 10 direct photographs of the Perseids as well as two trails photographed earlier in the summer and one more in the fall. In the last few years this group of observers has had the most consistent success of any in the photography of meteors with both spectrographs and direct cameras. Such results furnish good evidence of their unflagging zeal and the writer wishes them all success in the future.

RECENT METEORITE FALLS IN THE SOVIET

Dr. Astapowitsch also reports that during 1933 there were three meteorite falls observed in the U.S.S.R. These occurred as follows:

1. Aug. 8, 1933, at Repeev Khutor, in the Lower Volga district, a single iron (octahedrite) weight 7 kg.
2. Oct. 2, 1933, at Lebjagevka, in Western Siberia, broken into several stones (white chondrite).
3. Dec. 26, 1933, in the Ivanovo industrial district, about 200 km. east of Moscow, a main mass of 8 kg. and about 70 other pieces (this fall was witnessed in ten villages and the meteor remained visible until within 5 km. of the surface of the earth).

All three of the above falls are in the meteorite collection of the Lomonossov Institute in Moscow.

P. M. M.

NOTES AND QUERIES

Communications are invited, especially from amateurs. The Editor will try to secure answers to queries.

A New Telescope for the Lick Observatory

After years of pioneering investigation into suitable sites and obtainable instruments the Lick Observatory began its scientific work in 1888, and ever since then it has maintained a high standard of astronomical research, both as to quantity and quality. Its successive directors—Holden, Keeler, Campbell and Aitken—have all achieved distinction personally and through the able efforts of their staffs. Another valuable output of the observatory has been the continuous supply of competent young astronomers who have gone out to take responsible positions throughout the country.

The additions to the original equipment of the observatory have not been large. The chief one is the Crossley 36-inch reflector, presented in 1895. However, there have been numerous alterations and improvements, allowing the instruments to have been used assiduously and effectively. It is very pleasing to learn that the Carnegie Corporation of New York has allotted $65,000 to the observatory for the construction of a wide-angle star camera, or photographic telescope. It will be the largest and most powerful of its kind and will record stars down to the nineteenth magnitude. The designs for it have been prepared by Professor W. H. Wright, who will use it in a study of the structure and the dynamical relations of the galaxy, including the problem of its rotation. The instrument is to be ready for use before the end of 1936.

Popularizing Astronomy

When sending the article on the planet Mercury in the present issue Mr. W. G. Hale, of the University of Washington Library, Seattle, Wash., related some of his experiences in popularizing astronomy in that western town. As they are of general interest I take the liberty of quoting a portion of his letter.

A life-long student of the stars, in the summer of 1931 I gave to the students and visitors of this University's Summer School a series of twelve popular lectures on astronomy, illustrated by lantern slides and globe models of Mars, Venus, and Mercury. So many permanent residents, as well as

students, attended these "talks" and desired greatly a continuance of them that we formed the Seattle Astronomical Society, to meet weekly and keep up the good work. Since then, for over three years, we have met *every week*, I giving illustrated lectures on the popular side of astronomy, and we still maintain an average attendance of fifty. Our dues have resolved themselves into a simple freewill collection, which provides cash to obtain new illustrative slides and models of home construction, which latter seem to "put over" the facts of relative sizes and distances, and the character of the orbits of the planets; often on separate devices, one idea at a time. Local papers help us by inserting weekly notices of coming meetings, and a monthly star-map; while the local banks give us the occasional use of a big display window at a busy crossing, to stage a display of models of planetary orbits, meteor tracks intersecting them, and the like. The Seattle Public Library lends us an auditorium free, with light and storage facilities for lantern, etc.

I also give lantern "talks" to the business clubs and schools, which latter always interests the youngsters, and this week I had two calls, from East and West, respectively, for particulars of the construction of the orbital models. What we have done others may do too, if just one person knows a little astronomy, and is willing to give his time to the matter.

Venus as a Crescent with the Naked Eye

On several occasions during the past years the visibility of the crescent Venus with the unaided eye has been referred to in these Notes. In the *Milwaukee Astronomical Society Bulletin* for December 1934, Mr. H. W. Cornell discusses the question and describes the conditions under which he saw the crescent. The following is quoted from his account.

Years ago, when I was a lad in high school, I read of a Chaldean inscription which depicted the goddess representing the planet Venus with a crescent emblem. An archeologist argued that this must mean that the Chaldeans had invented the telescope, and he tried to demonstrate that the knowledge of astronomy possessed by the Chaldean priests was too extensive to account for without telescopic aid. He concluded that they possessed telescopes, or at least a telescope, perhaps as good as Galileo's. The crescent of Venus was his weightiest argument.

But could not that crescent have been seen with the naked eye? In an endeavour to solve this question I watched Venus when it was a morning star, very close to inferior conjunction. Before the sun rose, the irradiation from such a bright object was so great that not even with good opera glasses could any crescent be seen. As daylight advanced, Venus became very hard to see at all. For minutes at a time I would lose it. Yet its brightness was still great enough for the irradiation to obscure the crescent. Then I had a rare

bit of good luck. An eighth of a mile away (which, for naked eye observing, is an optically infinite distance, that is to say, the eye focusses the same as for the stars) there was a factory. It blew a whistle to summon its early shift of workers. As the cloud of steam arose from the whistle it passed in front of Venus. Carefully I watched that cloud of steam, my eye focussed on it, being thus adjusted to see the planet itself. The cloud of steam slowly dissipated, and, for two or three seconds only, the crescent appeared to my unaided eye. Then the steam entirely disappeared, and the crescent, too, was gone. Quickly I looked with opera glasses,—the crescent was at the exact angle at which I had seen it with the naked eye. There was no illusion. Neither was there a magnifying power in the steam. A cloud of dust, such as is common in the Chaldean deserts, would have done as well.

The Chaldean who saw that phenomenon over five thousand years ago must have had patience, good eyesight, persistence, acuteness, and exceptionally good physical conditions. Granted these, he could have, and doubtless did, see the crescent of Venus. I did—but only once. I consider it my most remarkable naked eye observation.

"Southern Stars", Vol. I, No. 1

For some years the New Zealand Astronomical Society has issued its *Monthly Notes* by a stencil manifolding process. This is now replaced by the Society's new journal which bears the name *Southern Stars*. The first number contains 16 pages 5½ × 8½ inches, exclusive of covers. The editor is Mr. I. L. Thomsen, a member of the staff of the Dominion Observatory, Wellington, from which the magazine is issued. The publication contains the minutes of the council of the New Zealand Astronomical Society, reports of local astronomical societies, articles on star colours, telescope making and current phenomena, as well as other interesting information. At the meeting of the Council on October 11, 1934, the secretary reported that he had sent congratulations to the Tasmanian Astronomical Society on its formation. May the good work continue! We wish the new journal a long and useful life.

Boy Scouts at the 1932 Eclipse

A tribute to the work of the Boy Scouts of the Province of Quebec during the total Solar Eclipse 1932 August 31, which was planned and organized by Mr. E. Russel Paterson, a member of the Council, Montreal Centre, R.A.S.C., has been received from Mr.

Shigeo Ishii, Tokyo Astronomical Observatory, Japan, who writes thus to Mr. Paterson:

"I have been making reductions of observations of the Solar eclipse 1932 August 31 for astronomy of position and it was my pleasure to include your precious results———."

The report on the observations made by the Scouts was prepared with maps by Mr. Paterson, and was published in the JOURNAL R.A.S.C. in 1933.—A. V. D.

TO BE BURIED ON THE MOON

The problem of travelling through space by means of a rocket continues to receive much consideration, and the researches of R. H. Goddard, a physicist of repute, have demonstrated the validity of the principle upon which its feasibility is based.

There are two important societies in the United States interested in this matter, the American Rocket Society, a national organization, and the Cleveland Rocket Society, sponsored by Edward L. Hanna, grandson of the well-known Mark Hanna. It is reported that Hanna has set aside a trust fund of $20,000 to provide for the ultimate burial of himself and his wife on the moon, provided they are not able to make the trip while they are alive.

Experiments are proceeding actively also in Germany, France, Austria and Russia. An interesting account of this work is given in the *New Outlook* (N.Y.) for October 1934, condensed in the *Reader's Digest* for December. Many hard-headed, practical men look on the conquest of interplanetary space as an attainable and important goal. We may recall that Jules Verne's imaginative tales of the undersea boat and the airship have become realities, and who can say that his imaginative flight to the moon will always remain visionary? A friend of the present writer suggests the organization of a lunar exploration company, with rich treasure as its object and believes that millions of people would subscribe for stock. The whole project shows the power of the imagination over the actions of man.

From Emerson's Essay on Self-Reliance (1841)

The civilized man has built a coach, but has lost the use of his feet. . . . He has a fine Geneva watch, but he fails of the skill to tell the time by the sun. A Greenwich nautical almanac he has, and so, being sure of the information when he wants it, the man on the street does not know a star in the sky. The solstice he does not observe, the equinox he knows as little; and the whole bright calendar of the year is without a dial in his mind.

Death of T. E. Espin

It is with regret that we learn of the death on December 2, 1934, of Rev. T. E. Espin, the eminent amateur astronomer of Tow Law, Co. Durham, England. In 1894 Mr. Espin was made a Corresponding Member of the Astronomical and Physical Society of Toronto (now the R.A.S.C.) and he has contributed a number of papers to its publications. Mr. W. Milburn, his colleague at Tow Law, writes that Mr. Espin was ill for months and seriously so for three weeks before his death.

Another Disc for the 200-Inch Telescope

On December 2, 1934, a second disc for the 200-inch telescope was poured at the Corning Glass Works, Corning, N.Y. The first disc, cast on March 25, 1934, could probably be used, but on account of the slight accident to the mould when it was being poured the Company decided to proceed at once to produce a second disc. The operation was carried out apparently with perfect success. In a previous issue, relying on a press report, it was stated that the new disc would be solid, not honeycombed on the back, but the report was incorrect. The new disc has a honeycombed back but, profiting by previous experience, the "cores" of the mould were constructed so that there was no fear of them breaking off. Annealing will require about ten months.

C.A.C.

MEETINGS OF THE SOCIETY

AT WINNIPEG

October 10, 1934.—The opening meeting of the season was held in Theatre F, University Building, Broadway, at 8.15 p.m. President D. R. P. Coats was in the chair. This was the annual social evening. The president's first duty, he said, was the painful one of reporting the deaths of three valued members since the middle of August. The Centre will keenly feel the loss of our late president, A. W. Megget, who passed away on August 18 after a short illness. He was one of our oldest and most faithful members and dearly loved friend. He loved astronomy and none did more to popularize its study than he. R. McCalman was another old and faithful member. He made his own telescope and several times contributed interesting and instructive talks at our meetings. T. W. Halligan died very suddenly. He joined the society more recently and was deeply interested in the study of the heavenly bodies. Other members paid tribute to the memories of these friends of the Society. Our secretary had written letters of sympathy in each case, from the Society. There was also reported the loss of one who, though not a member, was a friend of the society, Mr. E. L. Taylor. He very kindly did some legal work for our society and Mrs. Taylor is a past president. We feel that her loss is also ours.

A letter of July was read from Dr. P. M. Millman regarding the viewing of the Perseids in August. With no meetings being held and so many away it was not an opportune time, but the president was able to make some observations on August 12, and showed slides of them. Mr. J. R. Collins of Toronto, while on a tour, stopped off at Winnipeg in August and met the president and several of the members. Besides Mr. Coats' slides Dr. Warren also showed some of the Perseids in the field of Perseus and Cassiopeia, with their fire-fly resemblance; of sun-spots, the moon, and lightning, both common and dark. A number of mechanical slides illustrated the rotundity of the earth by ships sailing around it; transits of Venus; eclipses; and planetary and cometary motions. Some of Mr. Megget's slides were used, especially of nebulae, and also his charts. The society's telescope has been used extensively and with gratifying results. After the programme a social time was enjoyed by all, under the direction of Mrs. J. H. Kolb. Mrs. D. R. P. Coats and Mrs. L. A. H. Warren presided at the tea-table, and a very pleasant evening was brought to a close.

November 14, 1934.—The meeting was held in the usual place. President D. R. P. Coats was in the chair.

A communication from Dr. Millman regarding the meteoric display of Leonids in November was read, charts to be available for any who desire their use. The circuit of the society's telescope amongst the members was reported.

The speaker for the evening was Right Rev. T. W. Morton, recently appointed Professor of Astronomy to St. Mary's Academy. His subject was "The Elephant and the Tortoise", in reference to the belief of certain of the ancients that the earth was supported by an elephant, the strongest known animal, and that in turn by a tortoise with its strong hard shell. Though scientists may consider such ideas quite ludicrous, they themselves have not reached a satisfactory solution of the mechanism of the heavens or of the power that supports and sustains the universe. Tycho Brahe formulated some new ideas of the solar system. Galileo with his telescope introduced new methods of observation and accepted the Copernican theory. Kepler, another contemporary, formulated his famous laws. Then came Newton with the laws of gravitation and motion, the underlying basis of all modern astronomy. Through the knowledge of gravitation Neptune and Pluto were discovered. Einstein denied the existence of force, which may be explained by the inertia of the body moving with acceleration. But the laws of gravitation remain. The size of an object depends on the speed of travel. If a body could move with the speed of light, it would shrink to nothing. That light has weight has been verified. Eddington differed from Einstein in that the latter had not taken into account the atom structure, and only Eddington had reached the proper concept with his "point-event" theory. But the solution of it all is still the unknown quantity, even with such men as Einstein or Eddington, and we must take refuge in the knowledge that there is an Almighty Creator who is also the Sustainer of the Universe.

J. C. Howey, *Recorder.*

AT VICTORIA

November 23, 1934.—On this date the members of the Victoria Centre were afforded an oportunity of hearing Dr. Helen Sawyer Hogg deliver a most interesting lecture on the subject of "Comets—What Are They?"

Whilst the earliest records are of Chinese origin and date back to the year 610 B.C., Dr. Hogg stated that, as a matter of fact, it was not until the eighteenth century that any real conception of comets was made by Halley. He it was who first announced certain principles which governed the courses of these wanderers through space and he it was who predicted the reappearance in 1759 of a comet which had been previously observed in 1684. This is the particular comet which now bears his name and which did re-appear as he foretold. The lecturer stated that whilst there were only about 100 comets of great brilliance there were nevertheless estimated to be approimately 125,000 comets in existence. In a graphic manner Dr. Hogg described in detail what is known regarding the composition of the comets and of the elliptical courses which they pursue. Numerous interesting slides were displayed on the screen which served to emphasize the points in her lecture. Whilst our scientific knowledge of comets has substantially increased since the times of Halley it was pointed out by the lecturer that there were many problems still awaiting solution.

By courtesy of the president the meeting was, on this occasion, presided over by the immediate Honorary President, Mr. James Duff, M.A., who took occasion to inform those present that this was the last occasion on which Dr. Hogg would address the Centre as she would be leaving, with her husband, for the east in the near future. He also stated that Dr. Frank S. Hogg had accepted a lectureship in the Department of Astronomy, University of Toronto, and in fitting terms alluded to the keen interest which both the lecturer and her husband had always taken in the welfare of the Centre during their residence in this city. A vote of thanks was proposed by the president, Mr. H. Boyd Brydon, and seconded by Mr. Robert Peters, both of whom voiced the loss which the Centre was sustaining in the removal of Dr. and Mrs. Hogg from this city. They were both, however, wished every happiness and success in their new sphere of activities.

HORACE E. MOORE, *Secretary.*

AT VANCOUVER

November 20, 1934.—The twenty-sixth regular meeting was held in the Science Building of the University of British Columbia at 8.15 p.m. Dr. W. Ure presided. In the absence of the secretary, Dr. G. M. Shrum read the minutes of the last meeting.

Mr. C. A. McDonald reported on the "Sky for the Month." He showed how to construct sky maps and discussed his subject from the point of view of a navigator.

The chief speaker was Dr. J. A. Pearce of the Dominion Astrophysical Observatory, Victoria, B.C., who gave an addresse on "Our Galaxy: a Typical Spiral Nebula".

Dr. Pearce prefaced his lecture with a few remarks regarding the worth of the Society in general and of the activities of the various centres.

In order to show that our galaxy is a typical spiral nebula, the speaker compared the size, form and other characteristics of the nebulae with our own galactic system. In discussing the size and shape of the galaxy Dr. Pearce traced chronologically the development of our present conceptions. William Herschel, who may be called the father of sidereal astronomy, was the first to give us a model of the universe. He observed the stars in a series of small regions of the sky, obtaining their number and position, and deducing their distances. From these he was led to believe that our galaxy consisted of millions of stars grouped in a lenticular shape, about 7,500 light-years in diameter. John Herschel extended the work of his father to the southern hemisphere. In 1900 Easton pictured the Milky Way as a spiral nebula with the sun near the centre. At this time astronomers knew the real distances of only about 100 stars. Kapteyn (in 1922) from a study of the distribution, proper motions and magnitudes of the stars, estimated the diameter of the galaxy to be 60,000 light-years. He took as the limiting boundary the region where the density of the stars fall to one one-hundredth of that in neighbour-

hood of the sun. In 1915-20 Shapley attempted a determination of the size of the universe from a study of the globular clusters. From this he deduced the diameter of our galaxy as 300,000 light-years. The speaker then reviewed the work of Curtis (1920), Strömberg (1925), Plaskett and Pearce (1928-30), Trumpler (1930), Hubble (1932), Stebbins (1933) and finally the recent work of Plaskett and Pearce entitled "The Distance and Direction to the Gravitational Centre of the Galaxy from the Motions of the O5 to B7 Stars". This paper has been published in the Monthly Notices of the Royal Astronomical Society, June, 1934. Plaskett and Pearce, from a study of 1010 high-temperature stars, gives as the diameter of the galaxy 100,000 light-years, and the distance of the centre as 33,000 light-years.

Dr. Pearce then showed a number of photographs of the nearer spiral nebulae and pointed out the existence of star clouds, new stars and Cepheid variables in these extra-galactic nebulae, *e.g.*, it was shown that the Cepheids in Messier 33 were very similar to our galactic Cepheids. It was also shown that the luminosity function of these spirals was much the same as for our galaxy.

In concluding his remarks Dr. Pearce pointed out that William Herschel was correct in his assertion that our galaxy is a nebula. We know now that it is, and in addition we know its dimensions and the position of its centre.

At the conclusion of Dr. Pearce's address, the president, Dr. Ure, expressed the pleasure of the centre in having as a distinguished visitor, Dr. J. S. Plaskett. He congratulated Dr. Plaskett on being invited to give the Halley lecture early in 1935. Dr. Plaskett thanked the society and expressed his good wishes for the success of the centre. He complimented Dr. Pearce on his masterly review of present day conceptions of the size and constitution of the galaxy. This beautiful and complete theory is the result of work carried out in the last five to ten years. However, the history of science is full of examples of theories which, although supported by observations, have been fundamentally changed by new observations. No one knows what the next decade may produce.

Mr. Robert Christy for the Physics Club and Miss Phoebe Riddle for the Mathematics Club expressed their appreciation of the lecture.

December 11, 1934.—The annual meeting of the centre was held in the Science Building of the University of British Columbia at 8.15 p.m.. During the first part of the meeting Dr. Ure occupied the chair.

The secretary read the minutes of the past two meetings and then read his report of the year's activities. After the treasurer had presented his statement, the meeting proceeded to the election of officers for the coming year. The following were elected: Honorary President, Dean D. Buchanan; President, Professor W. H. Gage; First Vice-President, H. P. Newton; Second Vice-President, Mrs. C. M. Robson; Secretary, C. A. MacDonald; Treasurer, A. Outram.

Council: Mrs. Laura Anderson, H. C. B. Forsyth, J. L. Bennett, M. A. McGrath, H. A. Pitman, S. A. Richmond, Seto More, J. W. Moore, J. W. Pickin, and Past Presidents: J. Teasdale, Dr. G. M. Shrum, Dr. William Ure.

Dr. Ure thanked the retiring executive and the members of the society for their splendid co-operation. He then called upon the new president Professor Gage, to preside. The new president introduced the members of the executive for the coming year.

With the aid of a star map Mr. J. Teasdale explained the skies for the month of December. He was followed by two members of the society, Mr. H. P. Newton and Mr. Jorgensen. The former exhibited lantern slides of the observatory at Flagstaff, Arizona, which he had visited during the summer. The latter showed slides made from photographs, taken by himself, of the surface of the moon, sun spots, circumpolar stars, etc. The slides indicated the very fine work that can be done with but inexpensive apparatus.

The meeting then adjourned to one of the laboratories of the University where members and friends had an exhibition of a number of interesting objects. The Physics Department of the University, through the kindness of Dr. G. M. Shrum and Mr. George Volkoff, had set up an apparatus showing continuous and line spectra, Newton's rings, the principle of the Michelson interferometer and Fresnel's biprism. The Chemistry Department, through Dr. Ure, had apparatus showing the molecular motion of gases. Other contributions were made by Messrs. Teasdale, MacDonald, McGrath, Jorgensen, Newton, Moore. Of particular interest was a six-inch reflecting telescope built and exhibited by Colin Graham and a motor for the telescope constructed by Fred Buller.

WALTER H. GAGE, *Secretary.*

AT TORONTO

November 13, 1934.—A regular meeting was held at 8. p.m., in the McLennan Laboratory of the University of Toronto; Mr. R. A. Gray in the chair. Three candidates were elected to membership in the Society, viz:

Terry Quilter, 528 Balloil Street, Toronto.

Capt. George Fremer, 196 Indian Road, Toronto.

Member-at-Large:

C. D. Martin, B.A.Sc., Box 327, Noranda, Quebec.

The predictions of phenomena for the following two weeks were outlined by the acting-recorder. J. R. Collins replied to a query placed in the "question box" at the previous meeting: "What is the cause of the retrogression of the moon's nodes, and what is the resulting effect on eclipses?" Recent observations were reported by Messrs. Gray, Collins and others.

A new feature was introduced by Frederick L. Troyer, being a "newscast" of recent events in the world of astronomy and astronomers, prepared after the style of radio news commentators.

Mr. W. E. W. Jackson, assistant director of the Meteorological Service of

Canada, then presented his address, "Locating the Earth's Magnetic Poles." Mr. Jackson mentioned that while the north magnetic pole is fairly definitely located, the south magnetic pole is yet to be found. In addition to the north and south magnetic poles, there are a number of minor magnetic poles caused by local irregularities. Mr. Jackson stated that as the subject was rather involved, he would deal only with the north pole, and by means of lantern slides showed the instruments required and the various steps in observational work necessary in locating the pole. In 1831, Sir James Ross, while wintering in the vicinity of the land-body now known as Boothia Peninsula, in honor of Felix Booth, the backer of the Ross expedition, noted a dip of 89° 59′—the first discovery of the approximate location of the north magnetic pole. In 1904-05, Capt. Amundsen made a prolonged stay in the region, making magnetic observations from several stations. His results, including detailed reports of magnetic variations, after many years spent in reduction, were recently completed and published (1930) by the Geophysical Society of Norway.

November 27, 1934.—A regular meeting was held at 8.00 p.m., in the University of Toronto. Mr. R. A. Gray was in the chair.

Three candidates were elected to membership in the Society, viz.:

Albert J. Cater, 100 Lakeshore Boulevard, Toronto.

Frank W. Pepperdene, 55 Junkin Avenue, St. Catharines, Ont.

C. M. Schell, President of the Amateur Telescope Makers of Dayton, Ohio.

The last named is a member-at-large.

The report of the nominating committee, appointed by the chairman (consisting of Messrs. Collins, Gilchrist, Horning and Young), was presented by Mr. Collins. The following names were proposed for the Council of the Toronto section for 1935: Honorary Chairman, Dr. C. A. Chant; Chairman, A. R. Hassard, K.C.; Vice-chairman, E. J. A. Kennedy; Secretary, S. C. Brown; Treasurer, J. F. Maybee; Recorder, F. L. Troyer; Curator, R. S. Duncan.

Members of Council:—Dr. D. S. Ainslie, Dr. Lachlan Gilchrist, F. L. Harvey, Dr. F. S. Hogg, J. H. Horning, M.A., Dr P M. Millman, Rev. C. H. Shortt, M.A., Dr. R. K. Young. And the past presidents of the centre:—A. F. Hunter, M.A., J. R. Collins, and R. A. Gray, B.A.

Moved by Mr. Collins and seconded by H. G. Duncalfe, that the recommendations of the nominating Committee be approved. (Carried).

Dr. D. S. Ainslie, of the department of Physics, University of Toronto, then presented a paper on "Laboratory Sources of Light for Spectroscopic Investigations." Professor Ainslie described the various methods of exciting spectra as used for chemical analysis of materials, and by means of lantern slides and experimental demonstrations illustrated a number of these, including the carbon, iron and mercury arcs, flame spectra, spark discharge and vacuum arc. Some discussion followed and Dr. Ainslie replied to a number of questions from members and others interested in the phenomena of spectroscopy.

FREDERIC L. TROYER, *Recorder.*